

1 I claim:

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3 1. A section of piping for a concrete pump delivery system which has improved abrasion resistance  
4 and which also exhibits ease of cleaning after use, the piping comprising:

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6 a tubular metal body having an exposed exterior surface and an internal surface, the internal surface  
7 of the tubular body being plated with a deposit of chromium to give the section of piping a hard  
8 chromium case which resists abrasion.

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10 2. The section of piping of claim 1, wherein the chromium case has a thickness in the range from  
11 about 0.001 to 0.035 inches.

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13 3. The section of piping of claim 2, wherein the chromium case has a thickness of approximately  
14 0.010 inches.

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16 4. The section of piping of claim 3, wherein the internal surface of the tubular metal body is  
17 mechanically smoothed prior to applying the deposit of chromium.

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19 5. The section of piping of claim 4, wherein the internal surface of the tubular metal body is honed  
20 prior to applying the deposit of chromium.

1       6. A section of piping for a concrete pump delivery system having improved abrasion resistance  
2       which also exhibits ease of cleaning after use, the piping comprising:

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4       a tubular metal body having an exposed exterior surface and a generally cylindrical internal surface,  
5       the internal surface of the tubular metal body being uniformly plated with a deposit of chromium to  
6       give the section of piping a hard chromium case which resists abrasion, the deposit of chromium being  
7       applied by exposing the internal surface of the tubular metal body to an aqueous electrolyte solution  
8       at a current density and at a plating temperature sufficient to form a chromium deposit of desired  
9       thickness on the internal surface, the electrolyte solution containing at least water, chromic acid and  
10      a sulfate component.

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12      7. The piping of claim 6, wherein the electrolyte solution also contains an alkyl sulphonic acid and  
13      an anion of molybdenum.

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15      8. A method of improving the abrasion resistance of a section of piping for a concrete pump delivery  
16      system, the method comprising the steps of:

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18      providing a tubular metal body of a selected length having an exposed exterior surface and a generally  
19      cylindrical internal surface;

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21      exposing the internal surface of the tubular metal body to an aqueous electrolyte solution containing  
22      at least water, chromic acid and a catalyst to provide an increased plating rate, the internal surface  
23      being exposed to the electrolyte solution at a current density and at a plating temperature sufficient  
24      to form a chromium deposit of desired thickness on the internal surface, whereby the internal surface  
25      of the tubular metal body is plated with a deposit of chromium to give the section of piping a hard  
26      chromium case which resists abrasion.

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28      9. The method of claim 8, wherein the chromium case which is deposited has a thickness in the range  
29      from about 0.001 to 0.035 inches.

1       10. The method of claim 9, wherein the chromium case has a thickness of approximately 0.010  
2       inches.

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4       11. The method of claim 8, wherein the internal surface of the tubular metal body is mechanically  
5       smoothed prior to applying the deposit of chromium.

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7       12. The method of claim 11, wherein the internal surface of the tubular metal body is honed prior  
8       to applying the deposit of chromium.

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10      13. The method of claim 8, wherein the electrolyte solution also contains an alkyl sulphonic acid and  
11       an anion of molybdenum.

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13      14. A method of improving the abrasion resistance of a section of piping for a concrete pump  
14       delivery system, the method comprising the steps of:

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16      providing a tubular metal body of a selected length having an exposed exterior surface and a generally  
17       cylindrical internal surface;

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19      exposing the internal surface of the tubular metal body to an aqueous electrolyte solution, the  
20       aqueous electrolyte solution being formed by combining water, from about 250 to 300 grams per liter  
21       chromic acid, from about 2 to 4 grams per liter of a sulfate component and about 2 to 4 grams per  
22       liter of an alkyl sulphonic acid;

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24      adding from about 25 to 50 grams per liter of a source of molybdenum anions to the base electrolyte  
25       bath;

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27      exposing the workpiece to the aqueous electrolyte bath at a current density and at a plating  
28       temperature sufficient to form an alloy chromium deposit of desired thickness on the workpiece.

1       15. The method of claim 14, wherein the internal surface of the tubular metal body is exposed to the  
2       aqueous electrolyte bath at a current density in the range from about 15 to 100 A/dm<sup>2</sup> and at a plating  
3       temperature in the range from about 20 to 70 °C to form an alloy chromium deposit having at least  
4       about 0.5% molybdenum deposited.

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6       16. The method of claim 15, wherein the alkyl sulphonic acid is a saturated aliphatic sulphonic acid  
7       having a maximum of two carbon atoms and a maximum of six sulphonic acid groups or their salts  
8       or halogen derivatives thereon.

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10      17. The method of claim 16, further characterized in that the cathode efficiency of the process is  
11      greater than about 18%.

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13      18. The method of claim 17, wherein the current applied to the aqueous electrolyte bath is applied  
14      as pulsed direct current to provide an alloy chromium deposit having at least about 1.5% molybdenum  
15      deposited.